Canada

Department of Mines

Hon. CHARLES STEWART, Minister;
CHARLES CAMSELL, Deputy Minister

Geological Survey

W. H. COLLINS, Director

Bulletin No. 35

GEOLOGICAL SERIES, No. 42 OCTOBER 30, 1922

RELATIONSHIP OF THE PRECAMBRIAN (BELTIAN) TERRAIN TO THE LOWER CAMBRIAN STRATA OF SOUTHEASTERN BRITISH COLUMBIA

BY

S. J. Schofield

OTTAWA
GOVERNMENT PRINTING BUREAU
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CONTENTS

Illustrations

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INTRODUCTION

Rocks containing the *Olenellus* fauna were discovered near Cranbrook, B.C., by Col. C. H. Pollen, of Cranbrook, at the opportune moment when further work on the Beltian rocks of southeastern British Columbia was being planned by the Geological Survey. In April, 1921, Col. Pollen forwarded some specimens representing the *Olenellus* fauna to the University of British Columbia, Vancouver, B.C., and the place of discovery near Cranbrook served as a starting place for the field work of the Geological Survey, under the writer, which commenced in May of the same year. In the course of this field work efficient help was given by J. F. Walker of the University of British Columbia.

GENERAL STATEMENT OF THE PROBLEM

The relationship of the Cambrian to the Precambrian (Beltian) in southeastern British Columbia hinges upon the presence of an unconformity between these rock groups. Walcott includes in the Precambrian (Beltian) the strata which occur between the general unconformity that marks the base of the Cambrian, whether Lower, Middle, or Upper Cambrian and another unconformity at the top of the basement complex, which he classified as Archæan. In places the Cambrian rests with apparent conformity on the Beltian, but Walcott holds that a regional study proves the existence of a stratigraphical and time break between the known Beltian rocks and the Cambrian sediments of the North American continent. Dawson[1] held that complete stratigraphical conformity existed between the Cambrian and the Beltian down to the great unconformity which separates the Beltian from the basement complex. Daly[2] uses the term Belt-terrain to include all the Cordilleran strata which lie conformably below the *Olenellus* zone as well as the rocks which are contemporaneous with those strata though not in proved conformity with the *Olenellus* zone. He holds that no unconformity exists between the base of the Beltian and the Cambrian.

[1] Dawson, G. M., Bull. Geol. Soc. Am., vol. 2, 1891, p. 173.
[2] Daly, R. A., Geol. Surv., Can., Mem. 68, 1915, p. 58.

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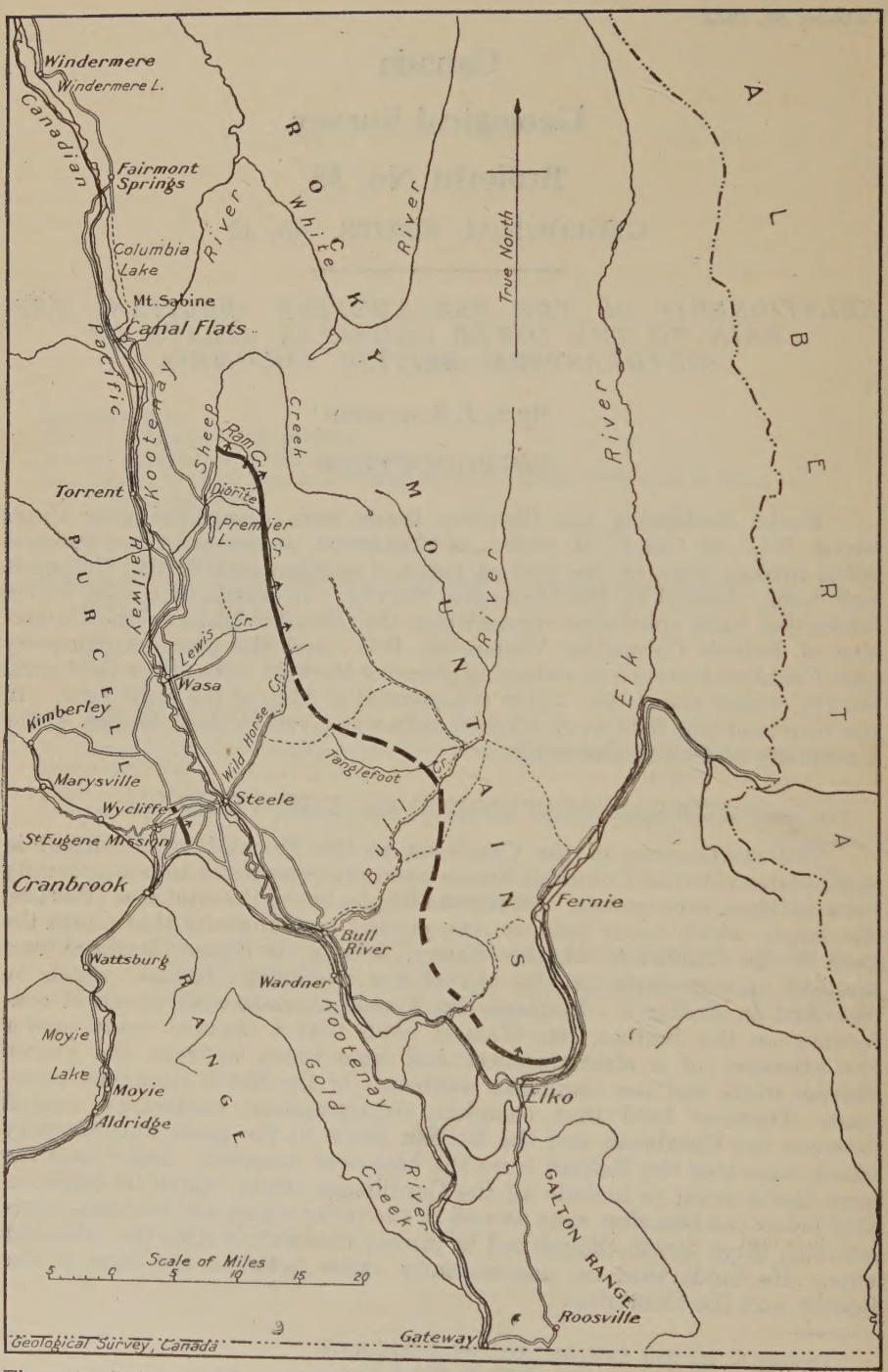

Figure 1. Index map showing location of the Precambrian-Cambrian contact in southeastern British Columbia. The contact is represented by the heavy black line.

GENERAL CLASSIFICATION OF THE ROCK SERIES

The rock series which enter into the particular problem under discussion were studied in Canada first along the International Boundary line in 1902, although the problem had been receiving attention in the United States since 1883. A comprehensive review of the whole subject is given by Daly[1]. The following table represents the two series of rocks which directly concern the particular problem in southeastern British Columbia.

Galton Series[2]

(Galton range)	Feet
Roosville	1,000
Phillips	500
Gateway	2,500
Purcell lava	300–
Siyeh	4,000
Wigwam	1,200
MacDonald	2,350
Hefty	775
Altyn	650

Base unexposed.

Purcell Series[3]

(Purcell range)	Feet
Gateway	1,000
Purcell lava	300–
Siyeh	4,000
Kitchener	4,500
Creston	5,000
Aldridge	8,000–

Base unexposed.

Daly holds that in the Purcell series the Aldridge formation only belongs to the Beltian, that the Creston and the lower part of the Kitchener are to be grouped in the Lower Cambrian, the upper part of the Kitchener is Middle Cambrian, and that in the Galton series the Altyn only belongs to the Beltian. In both series Daly considers the Beltian and the Lower Cambrian to be conformable.[4]

In 1913 the writer discovered a section near Elko, B.C., where fossiliferous Cambrian rocks are in contact with the Galton series. On the basis of the field facts at Elko the whole of the Galton and the Purcell series were assigned to the Precambrian.[5] The fossils collected in the Burton formation, which rests with disconformable relationships on the Roosville formation of the Galton series, were classified as lowest Middle Cambrian by Burling.[6] In 1916 Drysdale on a purely lithological correlation placed the part of the Purcell series above the Kitchener formation in the Lower Cambrian, thus restricting the Creston and Aldridge formation only to the Beltian.[7] The definition of the Burton formation as lowest Middle Cambrian by Burling rests on his contention that the Albertella fauna is restricted to the Middle Cambrian.[8] Walcott previously in 1908 placed the Albertella fauna in the Lower Cambrian.[9] In 1921 Walcott placed the upper 60 feet of the Burton in the Middle Cambrian and the remainder in the Lower Cambrian.[10]

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[1] Daly, R. A., Geol. Surv., Can., Mem. 38, 1912, p. 179.
[2] Daly, R. A., Geol. Surv., Can., Mem. 38, 1912, p. 97.
Schofield, S. J., Geol. Surv., Can., Mus. Bull. No. 2, 1914, p. 3.
[3] Daly, R. A., Geol. Surv., Can., Mem. 38, 1912, p. 119.
Schofield, S. J., Geol. Surv., Can., Mus. Bull. No. 2, 1914, p. 7.
[4] Daly, R. A., Geol. Surv., Can., Mem. 63, 1915, p. 94.
[5] Schofield, S. J., Geol. Surv., Can., Mus. Bull. No. 2, 1914.
[6] Burling, L. D., Geol. Surv., Can., Mus. Bull. No. 2, 1914, p. 125.
[7] Drysdale, C. W., Geol. Surv., Can., Sum. Rept., 1916, p. 61.
[8] Burling, L. D., Geol. Surv., Can., Mus. Bull. No. 2, p. 125.
[9] Walcott, C. D., Smithsonian Misc. Coll., vol. 55, 1908, p. 202.
[10] Personal communication 1921.

RELATIONSHIP OF THE GALTON SERIES (BELTIAN) TO THE LOWER CAMBRIAN AT ELKO, B.C.

The section at Elko was described in 1914[1] and represented the first description of the Cambrian-Precambrian contact in southeastern British Columbia.

The mountains to the north of Elk River valley at Elko, B.C., form the most westerly part of the Rockies system. The structure of these mountains is of the nature of a syncline striking northwest-southeast. The western limb of the syncline is cut off by a northwest-southeast fault, which brings the Devono-Carboniferous limestone in contact with the Roosville formation. The strata forming the western face of the Rocky mountains dip on an average 45 degrees to the northeast. Elko, a station on the Crowsnest branch of the Canadian Pacific railway, is situated on the western slope of the Rockies system, at the Elk River portal to the Kootenay valley or Rocky Mountain trench.[2]

The section exposed at Elko can be most easily expressed in a stratigraphical column.

		Feet
Devonian	Jefferson limestone	300
	Disconformity	
Middle Cambrian	Elko formation	90
	Burton formation (upper part)	60
Lower Cambrian	Burton formation (lower part)	18
	Disconformity	
Precambrian (Beltian)	Roosville formation	1,000
	Phillips formation	500
	Gateway formation	1,000
	Base unexposed.	

The Gateway, Phillips, and Roosville belong to the Galton series of Daly.[3]

Gateway Formation

The lower part of the formation consists of alternating bands of massive, concretionary, siliceous dolomite and limestone weathering buff; and massive grey quartzites. These are succeeded by thin-bedded, sandy argillites and greenish grey, siliceous argillites. The sandy argillites weather a light buff and contain abundant casts of salt crystals and ripple-marks.

Phillips Formation

The Gateway formation passes gradually into the overlying Phillips formation which consists mainly of dark purplish and red metargillites, sandy argillites, sandstones, and quartzites. At several horizons are intercalated thin laminæ of green siliceous argillite. These rocks are exposed in a rock-cut on the Great Northern railway, 1½ miles east of Elko, from which point they rise to the east in the hill to the north of the track.

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[1] Schofield, S. J., Geol. Surv., Can., Mus. Bull. No. 2, 1914, p. 3.
[2] Schofield, S. J., Trans. Roy. Soc. Can., vol. 14, sec. 4, p. 61, 1920.
[3] Daly, R. A., Geol. Surv., Can., Mem. 38, p. 97.

Roosville Formation

The Phillips is overlain conformably by the Roosville, which is composed mostly of massive, laminated, green, siliceous metargillites weathering greenish grey and rusty brown, and buff coloured sandstone. Mud-cracks are abundant at all horizons. The Elk River canyon is carved in the horizontal strata of the Roosville formation. Cryptozoon forms occur at several horizons near the top of the Roosville.

Burton Formation

The Burton formation, called after Burton creek, near Elko, rests with no discordance of dip on the Roosville siliceous metargillites, and consists in great part of greenish-black calcareous shales with interbedded siliceous limestone bands. A detailed section of the Burton formation at Elko is as follows:

		Feet
Elko formation		
Burton formation	Greenish black shales with limestone interbands	60
	Sandy limestone	10
	Greenish black shale	4
	Calcareous grit	3
	Hematitic conglomerate	1

The age of the Burton formation is determined by L. D. Burling[1] as lowest Middle Cambrian, on the basis of the fossils listed in the following section which is located directly back of the Burton mine about 2 miles northwest of Elko, B.C.

Section	Feet	Fauna
Elko limestone		
5. Greenish black shales with interbedded limestones, the limestone being in the form of lenses and stringers 1 to 3 inches in thickness and more or less continuous but making up a very small proportion of the strata.	60	In interbedded limestones within 5 feet of base: *Micromitra* (*Paterina*), *Micromitra* (*Iphidella*) *pannula*, *Obolus* sp., *Acrothele* sp., *Acrotreta* sp., *Agraulos* sp., *Ptychoparia* sp., *Albertella* sp., *Olenoides* sp., *Bathyuriscus* sp., and *Crepicephalus*, 2 species.
4. Massive, dirty grey, sandy limestone	10	Near top: *Micromitra* sp., *Micromitra* (*Iphidella*) *pannula*, *Agraulos* sp., trilobite fragments, 2 species. Near base: *Micromitra* (*Iphidella*) *pannula*, trilobite fragments 2 species, one suggesting *Olenellus*.
3. Green micaceous shale, badly sheared	4	One trilobitic fragment.
2. Rubbly weathering, calcareous grit, with annelid-like borings in top layer	3	Annelid borings, *Micromitra* (*Paterina*) sp., *Acrotreta* sp., trilobite fragments of 1 species.
1. Hematitic conglomerate	1	
Unconformity		
Roosville siliceous metargillites		(Precambrian)

[1] Burling, L. D., Geol. Surv., Can., Mus. Bull. No. 2, 1914, p. 125.

Burling concludes that "The correlation of the Burton formation with the *Albertella* fauna is based largely upon the presence in the former of an *Albertella*, a genus which, according to our present information, is confined in the Cordilleran region to this one horizon. The weight of evidence so largely opposed the Lower Cambrian age of these formations and corroborates their reference to the overlying division of the Cambrian that the Burton formation is referred with some degree of certainty to the Middle Cambrian."

"It is hard to resist the impression, however, that the clastic portion of the Burton formation may represent the Lower Cambrian, and while the few species occurring in these lower layers are either unrecognizable or referable to types hitherto unknown, the suggested division of the Burton formation will not invalidate its future division into shale and sandstone members."

"The Burton formation is, therefore, interpreted as a more or less heterogeneous formational unit unconformably overlying the Precambrian, and easily separable into upper and lower members if such a division should be warranted by future work upon the faunas of its basal portion."

In 1916 Burling[1] located the *Albertella* fauna in a shale member of the Middle Cambrian Cathedral limestone 375 feet above its base. This definitely places the upper part of the Burton formation in the Middle Cambrian.

Walcott in 1921 in a personal communication correlates the upper part of the Burton formation with the Ptarmigan formation[2], which carries the Middle Cambrian fauna (lower) including the *Albertella* fauna and the lower part of the Burton formation with the Mount Whyte formation of Lower Cambrian age. The section at Elko, therefore, may be represented according to Walcott as follows:

The Elko formation is correlated with the Cathedral formation of Middle Cambrian age.

	Elko	Feet
Middle Cambrian	Elko limestone	
	Burton formation, upper part	60
Lower Cambrian	Burton formation, lower part	18
	Unconformity	
Precambrian	Roosville formation	
(Galton series)	Phillips formation	
	Gateway formation	

Unconformity at the Base of the Burton[3]. Although no structural features emphasize the presence of an unconformity at the base of the Burton, yet from other evidence such an unconformity is believed to exist.

(1) A marine Cambrian transgression is inferred in the deposition of the Burton formation since this inference is in harmony with other sections of the Rocky Mountain geosyncline.

(2) The conglomerate at the base of the Burton is composed chiefly of hematitic material with pebble-like shape and minor quantities of pebbles of quartzite and quartz in a hematitic cement. A concentric structure suggesting concretions characterizes some of the hematitic constituents of the conglomerate. All the hematitic pebble-shaped elements probably represent subsequent erosion and concentration of hematite deposits which

[1] Burling, L. D., Am. Jour. Sci., vol. 42, 1916, p. 469.
[2] Walcott, C. D., Smithsonian Misc. Coll., vol. 67, No. 1, 1917, p. 1.
[3] Schofield, S. J., Geol Surv., Can., Mus. Bull. No. 2, 1914.

occur abundantly in the underlying Precambrian series. The quartzite pebbles are identical with the quartzites of the underlying Phillips formation. The occurrence of these pebbles already metamorphosed before the deposition of the Burton indicates a time interval between the deposition of the Roosville and Burton formations.

(3) The grit which overlies the conglomerate is characterized by the abundance of milky-white quartz pebbles evidently derived from the erosion of quartz veins which are known to be present in the underlying Roosville formation and in other members of the Precambrian series. Green pebbles of the Roosville siliceous metargillites are also present, and since they are metamorphosed similarly to the metargillites of the underlying Roosville, it supports the idea that the Roosville was metamorphosed before the Burton was laid down. Hence the idea of a time interval between the deposition of the Roosville and the Burton formations is strengthened.

(4) The difference in degree of metamorphism of the Roosville and the Burton formations is very striking in the field. The laminæ of the Roosville metargillites are so thoroughly cemented together that they always form steep cliffs, in fact the perpendicular walls of the Elk River canyon are carved in the Roosville formation. In contrast to this, the Burton formation weathers to a soft earth and is characterized by gentle slopes usually covered with vegetation.

RELATIONSHIP OF THE PURCELL SERIES TO THE LOWER CAMBRIAN NEAR CRANBROOK, B.C.

Six miles east of Cranbrook, B.C., on the Cranbrook-Fort Steele wagon road, an outcrop of shale containing Lower Cambrian fossils was exposed in an excavation made to obtain road material. In this area the basal member of the Lower Cambrian and its relationship to the Purcell series was discovered. This contact was traced northwards across the St. Mary river, at which point it disappears under the gravels which cover the floor of the Rocky Mountain trench. The accompanying map (Figure 2) illustrates the areal distribution of the several formations.

It is rather fortunate that in the vicinity of Cranbrook the section (an easterly dipping monocline) of the Purcell series which underlies the fossiliferous Lower Cambrian is complete down to and including its oldest known member, the Aldridge formation. It leaves no doubt whatever as to the horizon of the Purcell series, which is in contact with the Lower Cambrian. Also the Purcell lava, the best known horizon marker in the whole of the Purcell series, is exposed in the immediate vicinity of the Lower Cambrian-Precambrian contact. The geological column is expressed as follows:

		Feet
	Erosion surface	
Lower Cambrian	Eager formation	300
	Cranbrook formation	600
	Unconformity	
Precambrian	Siyeh formation	300–
	Purcell lava	100
	Siyeh formation	4,000
	Kitchener formation	4,500
	Creston formation	5,000
	Aldridge formation	8,000

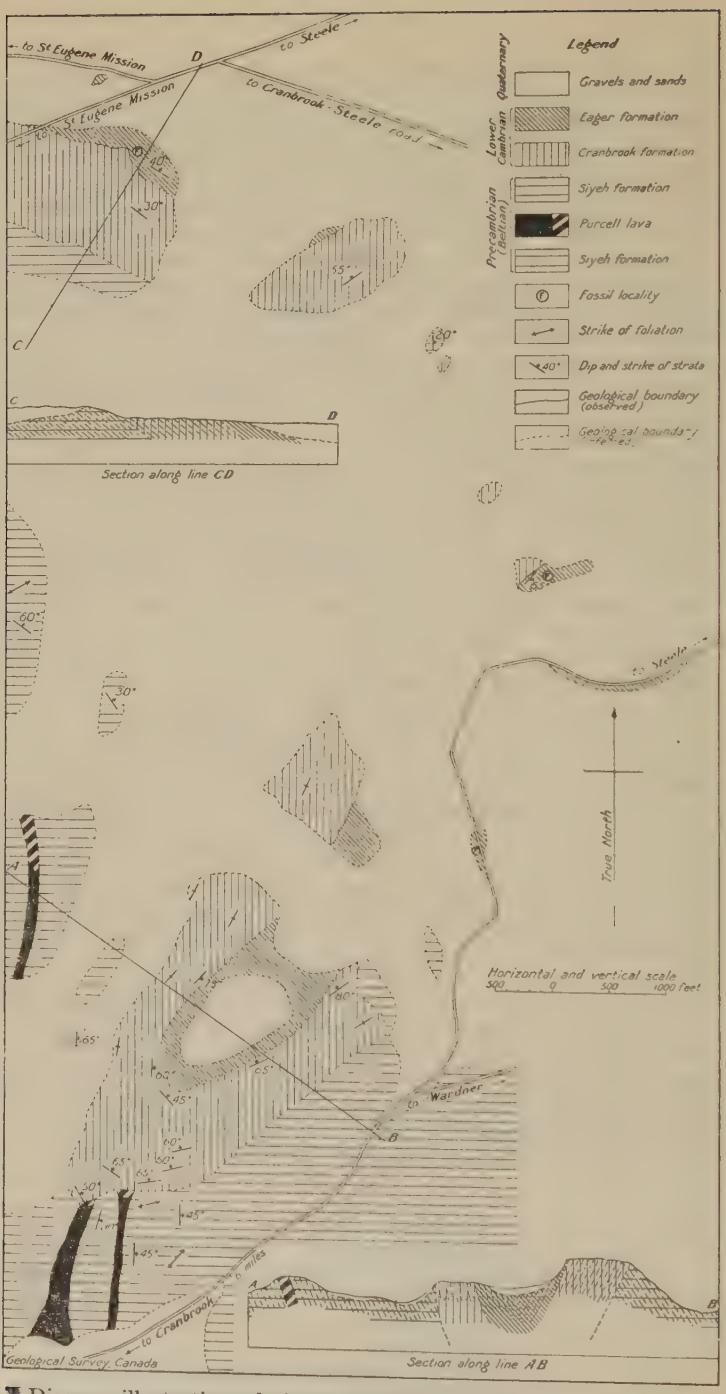

Figure 2.—Diagram illustrating relationship of the Precambrian and the Lower Cambrian formations near Cranbrook, B.C. (*See also* Figure 1.)

Aldridge Formation

The Aldridge formation, exposed along the railway east of Cranbrook, is made up of a series of argillaceous quartzites, purer quartzites, and argillites. The argillaceous quartzites form about three-quarters of the whole series and occur in beds with an average thickness of one foot. They are fine-grained rocks, dark grey to black on fresh fracture, and weather rusty brown, the most distinctive feature of the formation as a whole.

Creston Formation

The Aldridge formation passes by gradual transition into the overlying Creston quartzites. The lithology may be examined in the cuts along the wagon road from Cranbrook to Wycliffe. The Creston formation embraces a succession of greyish argillaceous quartzites and purer quartzites whose beds average about one foot in thickness. They are light grey on fracture and weather in greyish tones in contrast with the rocks of the underlying Aldridge formation.

Kitchener Formation

In comparison with the underlying Creston and Aldridge formations, the most notable feature of the Kitchener formation is its content of lime. These rocks are exposed in the low hill north of the intersection of the Cranbrook-Fort Steele wagon road and the Canadian Pacific railway, about 3 miles east of Cranbrook. The formation consists of calcareous and argillaceous quartzites and impure limestones in beds about 6 inches thick. The rocks are grey on fresh fracture, but weather, as a rule, yellowish brown and grey. The weathered surface of the limy members is pitted and marked parallel to the bedding planes by numerous linear depressions about one-eighth to one-quarter inch wide and one-half inch deep, whereas on the planes perpendicular to the bedding, these depressions are irregular and somewhat vermicular.

Siyeh Formation

The lower part of the Siyeh formation is composed of thin-bedded green and purple mud-cracked metargillites and sandstones. About 2,000 feet above the base of the Siyeh formation occur thin-bedded and massive siliceous and concretionary limestone, grey on fresh fracture and weathering usually a buff colour. These limestones, which are about 1,000 feet thick, are succeeded by purple and green mud-cracked metargillites in thin beds.

Purcell Lava

Near the top and interbedded with the rocks of the Siyeh formation occur flows of basalt from 50 feet to 300 feet in thickness. The top of the Siyeh formation is marked by one of these flows. The dominant rock of the Purcell lava is mainly a highly altered amygdaloidal or porphyritic basalt. The flows are generally heterogeneous in character.

Cranbrook Formation

This formation consists essentially of a fine-grained quartz conglomerate of prevailing white colour. Some of the strata have pink and red tints. Coarse conglomeratic beds occur among the fine-grained varieties and were noticed particularly about the middle of the formation and at the base. The base of the formation was clearly exposed in the section on the St. Eugene Mission-Fort Steele wagon road (Figure 2). Underlying the white quartzose conglomerate is 3 feet of a reddish sandy conglomerate containing pebbles of the underlying purple and green metargillites. No fossils were found in this formation which is 600 feet thick. The outcrop of the conglomerate formed projections through the overlying mantle of gravels and sands.

Eager Formation

This formation overlies the Cranbrook formation conformably. Near the top of the Cranbrook formation the conglomerate becomes more sandy and contains thin interbands of shale. In the section along the Cranbrook-Fort Steele wagon road the shales are chocolate brown and weather reddish. The joints in the shale are sometimes filled with an impure hematite evidently derived from the weathering of the shales. The fossils collected near the Cranbrook-Fort Steele road were identified by Dr. Charles D. Walcott, Secretary of the Smithsonian Institution, as follows:

Callavia cf. *nevadensis* Walcott
Wanneria n.sp. ?
Mesonacis gilberti Meek
Wanneria cf. *walcottanus* (Wanner)
Olenellus cf. *fremonti* Walcott
Prototypus senectus Billings

Dr. Walcott states concerning the collection: "This fauna belongs to the upper portion of the Lower Cambrian and it is essentially the same as that found above the tunnel at Mt. Stephen, B.C., and also found more or less all along the cordilleran system down into southern Nevada."

EVIDENCES OF AN UNCONFORMITY AT THE BASE OF THE CAMBRIAN IN THE CRANBROOK AREA

The presence of an unconformity between the Beltian and the Cambrian rocks in the Cordilleras was long ago recognized by Walcott. In Cranbrook area, the locality near the Cranbrook-Fort Steele wagon road does not show an exposure of the exact contact, but the structure and the areal distribution of the rocks (Figure 2) show that an unconformity exists. The evidence may be briefly summarized as follows:

(1) The Cambrian rocks form a syncline whose axis strikes a little north of east and plunges towards the east, whereas the underlying Beltian rocks strike north and south with a dip to the east. In the immediate vicinity of the contact the strikes of the two groups are thus at right angles to each other. The underlying series exhibits an extremely well-marked shearing whose strike corresponds in general to the axial strike of the overlying syncline of Cambrian rocks.

(2) The basal member of the Cambrian series is a well-bedded massive conglomerate, the well-rounded pebbles of which are composed chiefly of quartz and rounded pebbles of the underlying Precambrian rocks. This conglomerate is 600 feet thick and shows ripple-marks, and in some places crossbedding.

(3) The underlying Beltian rocks are siliceous metargillites, green and purple in colour, and are characterized by abundant mud-cracks and ripple-marks, evidence of shallow-water deposition. The Cambrian shows rocks of marine deposition.

(4) The Beltian rocks are well-indurated, siliceous metargillites, whereas the Cambrian rocks of similar nature are soft shales.

(5) The varying thickness of siliceous metargillites of the Siyeh formation between the Purcell lava and the basal conglomerate of the Cambrian shows that erosion has permitted the Cambrian rocks to rest on different horizons of the Precambrian.

RAM CREEK AREA

The eastern trench wall from Bull river to Diorite creek which enters the trench from the east about 15 miles south of Canal flats, is composed entirely of Beltian rocks which strike in a general way north and south with a dip to the east. As Diorite creek is approached the strike of the rocks swings around to the northeast, causing the Precambrian-Cambrian contact, which follows the strike of the trench about 10 miles to the east, to intersect and appear on the trench wall (Figure 1). Satisfactory exposures do not occur on the trench wall so that a section was roughly measured on a high ridge at the head of Ram creek.

The fossils listed in the following section were identified by Dr. Walcott.

Feet		
	Elko Limestone (Middle Cambrian)	
12	Sandy limestones and limestone (fossiliferous)	
	Olenellus sp. (many fragments)	
10	Red and green paper-like shales	
13	Limestones (fossiliferous), brownish weathering with yellow shale interbands	
	Hyolithes sp. (a small form that is common in the Mount Whyte formation near Field, B.C.)	
12	Limestones (fossiliferous), reddish and buff weathering	
	Olenellus (fragments similar to those above)	
25	Coarse crossbedded sandstone and conglomerate (white quartz pebbles)	
18	Yellowish buff-weathering, paper-like shales	
45	Red sandstone interbedded with yellowish buff-weathering, paper-like shales	
75	Sandstone and conglomerate mostly white, some shale interbands	
75	Massive, white conglomerate (quartz pebbles)	
75	Grey and brown sandstone with shale	
45	Greyish white sandstone	
50	White quartzites and yellow shales	
20	Red shales	
600	Massive white quartzite and conglomerate (quartz pebbles)	
20	Sandstones and buff-weathering dolomites, some shales (fossiliferous)	
	Waterworn minute fragments of trilobites, a species of *Salterella*	Lower Cambrian
	Olenellus fragments	
	Wanneria sp. Several good heads occur on slabs of sandstone	
600	Massive white quartzites and conglomerate (mainly quartz pebbles); lower 5 feet rounded fragments of underlying Beltian rocks	
	Disconformity or Unconformity	
1,000	*Roosville Formation.* Greenish grey, siliceous metargillites, some buff-weathering dolomites showing large concentric structures; mud-cracks abundant	
400	*Phillips Formation.* Interbanded red and purple metargillites, some massive and sandy, some thin bedded and argillaceous, some black siliceous bands, mud-cracks abundant	
1,500	*Gateway Formation.* Interbanded, massive, buff-weathering siliceous dolomites and yellow, sandy argillites showing numerous casts of salt crystals and ripple-marks	
	Purcell Lava. Amygdaloidal and porphyritic in two flows 50 feet thick	
	Siyeh Formation. Section continuous down to the Aldridge formation	

CANAL FLATS SECTION

A section of the Lower Cambrian rocks below the Elko limestone was examined on the south side of Kootenay river about 4 miles east of Canal flats. Kootenay river enters the Rocky Mountain trench from the east at Canal flats. The contact of the Lower Cambrian and the Precambrian is not exposed, but the strata from which the fossils were collected correspond to those of the Ram Creek section below the Elko limestone and above the very thick white quartzites and conglomerates. Dr. Walcott identified the following genera and species and made the following comments:

"*Olenellus* or *Mesonacis* (fragments)
Corynexochus fieldensis Walcott
Agraulos sp.
Micromitra (*Paterina*) *labradorica* Bill
Kutorgina cingulata Bill
Stenotheca rugosa Hall

The various species mentioned above are characteristic of the Lower Cambrian Mount Whyte formation of the section at McArthur pass and 3 miles east of Field, B.C. There is nothing to suggest a Middle Cambrian fauna except such forms as *Ptychoparia* and *Agraulos*. If the typical Burton is of Middle Cambrian age, then this formation is not to be correlated with the Burton but with the Mount Whyte formation."

"The section of the Burton near Elko, B.C., as published in 1914, indicated that 5 of the section is to be compared with Ptarmigan formation (Middle Cambrian) and 4, 3, 2 with the Mount Whyte formation (Lower Cambrian) of the section at Kicking Horse pass, east of Field, B.C."

GENERAL SUMMARY OF THE PRECAMBRIAN-CAMBRIAN CONTACT IN SOUTHEASTERN BRITISH COLUMBIA

(1) The Lower Cambrian conglomerate rests with no discordance of dip on the underlying Precambrian formations except in the southern part of the Cranbrook area, where the structural relationships indicate an unconformity of erosion. This general lack of structural discordance of strike and dip indicates that no orogenic movements could possibly have intervened between the Cambrian and Precambrian periods in southeastern British Columbia. The fact that the Lower Cambrian basal conglomerate rests on horizons so widely separated stratigraphically as the Siyeh and the Roosville indicates that several thousand feet of strata at least have been locally removed in the interval represented by the unconformity.

(2) The underlying Precambrian surface shows no evidence of weathering, the rocks at the contact being fresh and unaltered. The encroachment of the Lower Cambrian sea was presumably slow, thus permitting the entire erosion of the weathered surface.

(3) The basal conglomerate varies greatly in thickness, thus pointing to an irregular Precambrian land surface.

(4) The fineness of the basal conglomerate together with its mineralogical composition, mainly quartz, indicates thorough weathering of the Precambrian land surface and an almost perfect sorting of these products by the advancing Lower Cambrian sea. Also the fineness of the basal conglomerate indicates comparatively mild transportation agents and, by inference, a neighbouring Precambrian land surface of low relief.

(5) The Lower Cambrian rocks are marine, whereas the Precambrian rocks are generally considered to be of continental origin. Marine fossils are the rule in the Cambrian; mud-cracks, ripple-marks, and casts of salt crystals are present in great abundance in the Precambrian formations.

(6) The presence of the unconformity between the Lower Cambrian and the Precambrian places definitely the Purcell series and its equivalents in the Beltian or Precambrian.

(7) The following table represents a preliminary correlation of the sections at Cranbrook, Elko, and Ram creek.

	Cranbrook section	Thickness	Elko section	Thickness	Ram Creek section	Thickness
		Feet		Feet		Feet
Devonian			Jefferson ? limestone	500+		
			Disconformity			
Middle Cambrian			Elko formation	90	Elko formation	1,000+
			Burton formation (upper part)	60		
					Burton formation	475
Lower Cambrian	Eager shales	300	Burton formation (lower part)	17		
	Cranbrook conglomerates	600	Cranbrook conglomerates	1	Cranbrook conglomerates	1,220
	Unconformity		*Disconformity or Unconformity*		*Disconformity or Unconformity*	
			Roosville formation	1,000	Roosville formation	1,000
			Phillips formation	500	Phillips formation	400
			Gateway formation	2,000+	Gateway formation	1,500
Beltian (Precambrian)	Siyeh formation	300	Base unexposed		Siyeh formation	500
	Purcell lava	−100			Purcell lava	50
	Siyeh formation	4,000			Siyeh formation	4,000
	Kitchener formation	4,500			Kitchener formation	4,500
	Creston formation	5,000			Creston formation	5,000
	Aldridge formation	8,000			Aldridge formation	5,000
	Base unexposed				Base unexposed	